

Claims

- [c1] A temperature controlled hydraulic fluid supply circuit comprising:
a first hydraulic fluid reservoir having an initial hydraulic fluid;
a first temperature controlled housing;
a second hydraulic fluid reservoir fluidically coupled to said first hydraulic fluid reservoir, residing within said first temperature controlled housing, and having a controlled hydraulic fluid that is supplied to at least one test device; and
a circulation device circulating a temperature altering fluid through said first temperature controlled housing and adjusting a temperature of said controlled hydraulic fluid.
- [c2] A circuit as in claim 1 further comprising a plurality of hydraulic fluid control valves controlling flow of said initial hydraulic fluid and said controlled hydraulic fluid and supplying said controlled hydraulic fluid to said at least one test device.
- [c3] A circuit as in claim 2 wherein said plurality of hydraulic fluid control valves separate said initial fluid from said

controlled fluid.

- [c4] A circuit as in claim 1 further comprising a second temperature controlled housing containing said at least one test device therein.
- [c5] A circuit as in claim 4 wherein circulation device circulates said temperature altering fluid through said second temperature controlled housing and adjusts temperature of said at least one test device.
- [c6] A circuit as in claim 1 wherein said second hydraulic fluid reservoir is in the form of a cylinder housing having a hydraulic piston.
- [c7] A circuit as in claim 1 wherein said hydraulic fluid test circuit comprises at least one configuration selected from a fill configuration, a use configuration, and a bypass configuration.
- [c8] A circuit as in claim 1 wherein said temperature altering fluid is such to perform at least one test of said at least one test device selected from a cold test and a warm test.
- [c9] A hydraulic device test system comprising:
 - a hydraulic fluid test circuit comprising;
 - a first hydraulic fluid reservoir having an initial hydraulic

fluid;

a first temperature controlled housing;

a second hydraulic fluid reservoir fluidically coupled to said first hydraulic fluid reservoir, residing within said temperature controlled housing, and having a controlled hydraulic fluid;

a circulation device circulating a temperature altering fluid through said first temperature controlled housing and adjusting temperature of said controlled hydraulic fluid; and

a plurality of hydraulic fluid control valves controlling flow of said initial hydraulic fluid and said controlled hydraulic fluid and supplying said controlled hydraulic fluid to at least one test device.

[c10] A test system as in claim 9 wherein said temperature altering fluid is in the form of a liquid or a gas.

[c11] A test system as in claim 9 wherein said first temperature controlled housing comprises:
an air inlet; and
an air outlet.

[c12] A test system as in claim 9 further comprising at least one pressure sensor detecting at least one fluid pressure within said hydraulic fluid test circuit.

- [c13] A test system as in claim 12 further comprising a controller coupled to said at least one pressure sensor and indicating said at least one fluid pressure.
- [c14] A test system as in claim 9 wherein said at least one pressure sensor detects pressure of at least one output of said first hydraulic fluid reservoir and said second hydraulic fluid reservoir.
- [c15] A test system as in claim 9 further comprising at least one temperature sensor detecting at least one temperature of at least one fluid within said hydraulic fluid test circuit.
- [c16] A test system as in claim 15 further comprising a controller coupled to said at least one temperature sensor and indicating said at least one temperature.
- [c17] A test system as in claim 16 wherein said controller adjusts said temperature adjusting fluid in response to said at least one temperature.
- [c18] A test system as in claim 15 wherein said at least one temperature sensor detects temperature of at least one of said first hydraulic fluid reservoir, said first temperature controlled housing, said second hydraulic fluid reservoir, said at least one test device, an output of said second hydraulic fluid reservoir, a second temperature

controlled housing, said initial hydraulic fluid, said controlled hydraulic fluid, and said temperature altering fluid.

[c19] A test system as in claim 9 further comprising a second temperature controlled housing containing said at least one test device therein.

[c20] A test system as in claim 19 wherein said circulation device circulates said temperature altering fluid through said second temperature controlled housing and adjusts temperature of said at least one test device.

[c21] A test system as in claim 19 wherein said second temperature controlled housing is fluidically coupled to said first temperature controlled housing.

[c22] A test system as in claim 19 wherein said first temperature controlled housing, said second temperature controlled housing, and said circulation device are in series and form a single continuous fluidic circuit.

[c23] A test system as in claim 9 wherein said second hydraulic fluid reservoir is in the form of a cylinder housing having a hydraulic piston.

[c24] A test system as in claim 9 wherein said second hydraulic fluid reservoir comprises:

an output side; and
a pressure side.

- [c25] A test system as in claim 24 wherein said output side receives said initial hydraulic fluid when said hydraulic fluid test circuit is operating in a fill configuration.
- [c26] A test system as in claim 24 wherein said pressure side receives said initial hydraulic fluid when said hydraulic fluid test circuit is operating in a use configuration.
- [c27] A test system as in claim 24 wherein neither said output side nor said pressure side receive said initial hydraulic fluid when said hydraulic fluid test circuit is operating in a bypass configuration.
- [c28] A test system as in claim 24 wherein said at least one hydraulic fluid control valve comprises:
a fill valve controlling flow of said initial hydraulic fluid into said output side; and
a pressure valve controlling flow of said initial hydraulic fluid into said pressure side.
- [c29] A test system as in claim 9 wherein said at least one hydraulic fluid control valve comprises:
an inlet valve controlling flow of said initial hydraulic fluid out of said first hydraulic fluid reservoir;
a return valve controlling flow of said initial hydraulic

fluid out of said second hydraulic fluid reservoir; and
an output valve controlling flow of said controlled hydraulic fluid to said at least one test device.

[c30] A test system as in claim 9 wherein said temperature altering fluid is such to perform at least one test of said at least one test device selected from a cold test and a warm test.

[c31] A hydraulic device test system comprising:
a hydraulic fluid test circuit comprising;
a first hydraulic fluid reservoir having an initial hydraulic fluid;
a first temperature controlled housing;
a second hydraulic fluid reservoir fluidically coupled to said first hydraulic fluid reservoir, residing within said temperature controlled housing, and having a controlled hydraulic fluid;
a circulation device circulating a temperature altering fluid through said first temperature controlled housing and adjusting temperature of said controlled hydraulic fluid; and
a plurality of hydraulic fluid control valves controlling flow of said initial hydraulic fluid and said controlled hydraulic fluid and supplying said controlled hydraulic fluid to at least one test device;
at least one temperature sensor coupled to said hy-

draumatic fluid test circuit and generating at least one temperature signal; and
a controller coupled to said hydraulic fluid test circuit and said at least one sensor and adjusting at least one of said initial hydraulic fluid, said controlled hydraulic fluid, temperature altering fluid in response to said at least one temperature signal.

[c32] A test system as in claim 31 wherein said controller signals said circulating device to alter temperature of said controlled hydraulic fluid in response to said at least one temperature signal.

[c33] A test system as in claim 31 further comprising a second temperature controlled housing containing said at least one test device, said controller signaling said circulating device to alter temperature within said second temperature controlled housing in response to said at least one temperature signal.

[c34] A method of testing at least one hydraulic device comprising:
determining at least one operating environment temperature of the at least one hydraulic device;
attaching a temperature controlled hydraulic fluid supply circuit and supplying a controlled hydraulic fluid therefrom to the at least one hydraulic device;

adjusting temperature of said controlled hydraulic fluid to be approximately the same as said at least one operating environment temperature;
actuating the at least one hydraulic device; and
evaluating performance of the at least one hydraulic device.

[c35] A method as in claim 34 wherein actuating said at least one hydraulic device comprises actuating said at least one hydraulic device within a temperature controlled housing having an internal temperature that matches that of said operating environment.

[c36] A method as in claim 34 wherein supplying hydraulic fluid to the at least one hydraulic device comprises:
filling an output side of a hydraulic fluid reservoir;
supplying an initial hydraulic fluid to a pressure side of the hydraulic fluid reservoir; and
releasing said controlled hydraulic fluid from said output side to the at least one hydraulic device.

[c37] A method as in claim 34 comprising:
determining a first operating environment temperature;
actuating the at least one hydraulic component utilizing said controlled hydraulic fluid at said first operating environment temperature;
determining a second operating environment tempera-

ture; and

actuating the at least one hydraulic component utilizing said controlled hydraulic fluid at said second operating environment temperature;

- [c38] A method of producing a desired hydraulic device comprising:
- determining an operating environment of the desired hydraulic device;
 - designing a hydraulic device prototype in response to said operating environment;
 - manufacturing said hydraulic device prototype in response to said design;
 - testing said hydraulic device prototype utilizing a temperature controlled hydraulic fluid supply circuit comprising;
 - attaching and supplying a controlled hydraulic fluid from said temperature controlled hydraulic fluid supply circuit to said hydraulic device prototype;
 - adjusting temperature of said hydraulic fluid to be a temperature of said operating environment.
 - actuating said hydraulic device prototype; and
 - evaluating performance of said hydraulic device prototype; and
 - producing the desired hydraulic device in response to said test evaluation.

- [c39] A method as in claim 37 wherein actuating said at least one hydraulic device prototype comprises actuating said at least one hydraulic device prototype within a temperature controlled housing simulating said operating environment.
- [c40] A method as in claim 37 wherein supplying controlled hydraulic fluid to the at least one hydraulic device comprises:
- filling an output side of a hydraulic fluid reservoir;
 - supplying an initial hydraulic fluid to a pressure side of the hydraulic fluid reservoir; and
 - releasing said controlled hydraulic fluid from said output side to the at least one hydraulic device prototype.